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TABLES

21. SCREENING OF ALTERNATIVES

The screening of remedial alternatives for WAG 10 sites is discussed in this section. In accordance with the EPA guidance for conducting an RI/FS under CERCLA (EPA 1988), each remedial alternative identified in Section 20 was evaluated against three general criteria: effectiveness, implementability, and cost. Detailed descriptions of these criteria are given in EPA guidance for conducting feasibility studies under CERCLA (EPA 1988). A general description of each screening criterion follows:

- **Effectiveness**—Effectiveness is the most important aspect of the screening evaluation. This criterion is used to assess the ability of an alternative to provide both short- and long-term protection of human health and the environment. In this application, short-term refers to the implementation period (i.e., the construction phase) and long-term refers to the period thereafter. The ability to reduce the toxicity, mobility, and volume of the contaminated material also is included as a measure of effectiveness.

- **Implementability**—The implementability criterion is used to assess the technical and administrative feasibility of implementing an alternative. Technical feasibility includes the construction, operation, and maintenance required for implementation of the remedial action. Administrative feasibility includes regulatory and public acceptance, availability of services and specialized equipment, and personnel requirements. Short-term implementability refers to the implementation period itself (i.e., during the remedial action), and long-term implementability refers to the operation, maintenance, and institutional control period thereafter.

- **Cost**—The cost criterion is used to assess the relative magnitude of capital and operating costs for an alternative during the specified period of active control. Short-term cost refers to the implementation period, and long-term cost refers to the operation, maintenance, and institutional control period thereafter.

A description of each alternative developed in Section 20 is provided below to evaluate effectiveness, implementability, and cost. These descriptions are intended to provide sufficient detail to distinguish among the alternatives relative to the three screening criteria. Each description provides general information about the technologies composing an alternative and the applicability of those technologies to the conditions at WAG 10. The following subsections provide a description of each alternative and an evaluation based on the three screening criteria. Specific assumptions for cost-estimating purposes are in Appendix I.

21.1 Remedial Alternatives for TNT/RDX Contaminated Soils

21.1.1 Alternative 1: No Action

21.1.1.1 Description. The *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP) (40 CFR 300.430 [e][6]) requires consideration of a no action alternative to serve as a baseline for evaluation of other remedial alternatives. Under the no action alternative, no land use restrictions, controls, or active remedial measures would be implemented at the site. Risk levels would be reduced only through natural processes. Environmental monitoring can be part of a no action alternative while DOE has institutional control of the INEEL, which includes the Site operational period and at least 100 years following Site closure.

Environmental monitoring would be performed to detect contaminant migration and to identify exposures from soil, air, and groundwater. Monitoring results would be used to determine the need for any future remedial actions necessary to protect human health and the environment. Monitoring is no longer conducted until a future review of the remedial action determined that further monitoring would not be required. Soil, air, and groundwater environmental monitoring activities would be performed under WAG- and INEEL-wide comprehensive monitoring programs to the extent practicable. Chemical surveys would be performed at sites with contaminated media remaining in place as part of this remedial action until Site-wide environmental monitoring programs are implemented. Groundwater monitoring requirements would be identified in reviews conducted every 5 years to evaluate the effectiveness of the institutional controls and the need for further environmental monitoring or additional control measures as applicable. The 5-year site reviews would be conducted for a 100-year period. Air monitoring would be conducted as part of the INEEL-wide air monitoring program.

21.1.1.2 Evaluation. The no action alternative could be implemented easily at moderate cost at all sites. However, the no action alternative is ineffective in mitigating risks and does not meet RAOs. Estimated costs for the no action alternative are provided in Table 21-1.

21.1.2 Alternative 2: Limited Action

21.1.2.1 Description. Alternative 2 consists of the following remedial actions to protect human health and the environment against potential risks associated with WAG 10 TNT/RDX soil sites:

- Institutional controls including access and deed restrictions
- Long-term environmental monitoring (the same as for the no action alternative).

Access and deed restrictions would be implemented and enforced, as necessary, to prevent direct and indirect exposure to surface and subsurface contamination.

Access to the INEEL is currently restricted for security and public safety. Because WAG 10 UXO soil sites are located within the boundaries of the INEEL, Sitewide access restrictions would limit accessibility for the duration of DOE control, which is assumed to be 100 years. Continued maintenance of the existing fences also could be necessary. Other access control measures would include warning signs, assessing trespassing fines, and establishing training requirements for persons allowed access. Land-use restrictions would be specified if government control of the INEEL is not maintained throughout the institutional control period.

Table 21-1. Base cost, escalated cost, and discounted cost (net present value) of capital, operating and maintenance, and total costs for remedial alternatives at WAG 10 TNT/RDX contaminated soil sites.

TEC SUMMARY COMPARISON REPORT

Project **WAG 10 OU10-04 FEASIBILITY STUDY - TNT/RDX** Date: **06/13/01**
Location **TNT/RDX SOIL SITES**
File # **8951-2**

Description	No Action				Limited Action				RA - Opt. 3A				RA - Opt. 3B			
	Midpt.	Base Cost	Esc'd Cost	Disc. Cost	Midpt.	Base Cost	Esc'd Cost	Disc. Cost	Midpt.	Base Cost	Esc'd Cost	Disc. Cost	Midpt.	Base Cost	Esc'd Cost	Disc. Cost
CAPITAL COSTS:		**535,469**	**580,926**	**499,610**		**961,935**	**4,295,446**	**848,436**		**1,436,796**	**4,816,066**	**1,287,976**		**1,524,301**	**4,913,412**	**1,368,062**
Remedial Design		**384,970**	**416,596**	**359,871**		**791,330**	**4,108,819**	**690,251**		**946,415**	**4,276,644**	**835,225**		**946,415**	**4,276,644**	**835,225**
RD/RA Statement of Work	2003	54,482	58,958	50,930	2003	54,482	58,958	50,930	2003	81,723	88,437	76,395	2003	81,723	88,437	76,395
Remedial Design Work Plan	2003	17,444	18,877	16,307	2003	17,444	18,877	16,307	2003	10,673	11,550	9,977	2003	10,673	11,550	9,977
Envir., Safety and Health Plan	2003	101,170	109,481	94,574	2003	101,170	109,481	94,574	2003	101,170	109,481	94,574	2003	101,170	109,481	94,574
Sampling and Analysis Plan	2003	108,964	117,916	101,860	2003	108,964	117,916	101,860	2003	108,964	117,916	101,860	2003	108,964	117,916	101,860
Quality Assurance Proj. Plan	2003	12,107	13,102	11,318	2003	12,107	13,102	11,318	2003	24,214	26,203	22,635	2003	24,214	26,203	22,635
Site Ops and Maint. Plan	2003	12,107	13,102	11,318	2003	12,107	13,102	11,318	2003	36,321	39,305	33,953	2003	36,321	39,305	33,953
Draft Final Design/Report Prep.			0	0			0	0	2003	24,214	26,203	22,635	2003	24,214	26,203	22,635
Remedial Action Work Plan	2003	63,562	68,784	59,418	2003	63,562	68,784	59,418	2003	63,562	68,784	59,418	2003	63,562	68,784	59,418
Plans and Specifications			0	0	2003	10,000	10,822	9,348	2003	75,000	81,161	70,110	2003	75,000	81,161	70,110
Deed Restriction Reviews			0	0	2050	396,360	3,681,401	321,032	2050	396,360	3,681,401	321,032	2050	396,360	3,681,401	321,032
Misc. Envir. Documents	2003	15,134	16,377	14,147	2003	15,134	16,377	14,147	2003	24,214	26,203	22,635	2003	24,214	26,203	22,635
Remediation Support		**66,589**	**72,059**	**62,248**		**66,589**	**72,059**	**62,248**		**156,688**	**169,560**	**146,472**		**156,688**	**169,560**	**146,472**
Quality Assurance			0	0			0	0	2003	23,510	25,441	21,977	2003	23,510	25,441	21,977
Project Office Operations	2003	66,589	72,059	62,248	2003	66,589	72,059	62,248	2003	133,178	144,119	124,495	2003	133,178	144,119	124,495
Remediation/Tech. Support Act.		**35,481**	**38,396**	**33,168**		**37,794**	**40,899**	**35,330**		**44,735**	**48,410**	**41,818**		**44,735**	**48,410**	**41,818**
Engineering & Tech. Support	2003	35,481	38,396	33,168	2003	37,794	40,899	35,330	2003	44,735	48,410	41,818	2003	44,735	48,410	41,818
Remedial Action		**0**	**0**	**0**		**17,793**	**19,794**	**16,284**		**240,529**	**267,577**	**220,136**		**328,034**	**364,922**	**300,222**
Mobilization & Prep. Work			0	0			0	0	2004	6,452	7,178	5,905	2004	6,452	7,178	5,905
Sitework			0	0	2004	17,793	19,794	16,284	2004	200,122	222,626	183,155	2004	287,627	319,971	263,241
Site Restoration			0	0			0	0	2004	9,290	10,336	8,502	2004	9,290	10,336	8,502
Demobilization			0	0			0	0	2004	6,452	7,178	5,905	2004	6,452	7,178	5,905
Other			0	0			0	0	2004	18,213	20,261	16,669	2004	18,213	20,261	16,669
Removal Actions		**48,429**	**53,875**	**44,323**		**48,429**	**53,875**	**44,323**		**48,429**	**53,875**	**44,323**		**48,429**	**53,875**	**44,323**
Summary Report	2004	48,429	53,875	44,323	2004	48,429	53,875	44,323	2004	48,429	53,875	44,323	2004	48,429	53,875	44,323
OPERATIONS COSTS:		**2,726,803**	**25,326,611**	**2,208,575**		**4,578,743**	**42,527,473**	**3,708,554**		**2,494,810**	**23,171,854**	**2,020,672**		**2,494,810**	**23,171,854**	**2,020,672**
Cleanup Tech. Admin. Activities		**1,816,070**	**16,867,701**	**1,470,926**		**1,816,070**	**16,867,701**	**1,470,926**		**1,816,070**	**16,867,701**	**1,470,926**		**1,816,070**	**16,867,701**	**1,470,926**
Proj. & Baseline Mgmt./Report	2050	1,816,070	16,867,701	1,470,926	2050	1,816,070	16,867,701	1,470,926	2050	1,816,070	16,867,701	1,470,926	2050	1,816,070	16,867,701	1,470,926
Post ROD Ops and Maintenance		**0**	**0**	**0**		**1,851,940**	**17,200,863**	**1,499,979**		**0**	**0**	**0**		**0**	**0**	**0**
Caretaker Maintenance			0	0	2050	1,851,940	17,200,863	1,499,979			0	0			0	0
Monitoring		**910,733**	**8,458,910**	**737,648**		**910,733**	**8,458,910**	**737,648**		**678,740**	**6,304,153**	**549,746**		**678,740**	**6,304,153**	**549,746**
Field Sampling Plan	2050	13,621	126,512	11,032	2050	13,621	126,512	11,032	2050	13,621	126,512	11,032	2050	13,621	126,512	11,032
Sampling	2050	618,648	5,746,017	501,074	2050	618,648	5,746,017	501,074	2050	386,655	3,591,261	313,171	2050	386,655	3,591,261	313,171
5-Year Reviews	2050	278,464	2,586,380	225,542	2050	278,464	2,586,380	225,542	2050	278,464	2,586,380	225,542	2050	278,464	2,586,380	225,542
G&A and PIF		**0**	**0**	**0**		**690**	**6,409**	**559**		**7,386**	**68,601**	**5,982**		**9,559**	**88,784**	**7,742**
Non-Org G&A and PIF			0	0	2050	690	6,409	559	2050	7,386	68,601	5,982	2050	9,559	88,784	7,742
SUBTOTAL COSTS		**3,262,272**	**25,907,537**	**2,708,185**		**5,541,368**	**46,829,328**	**4,557,549**		**3,938,992**	**28,056,522**	**3,314,630**		**4,028,670**	**28,174,050**	**3,396,476**
Plus: 30% Contingency		978,682	7,772,261	812,455		1,662,410	14,048,798	1,367,265		1,181,698	8,416,957	994,389		1,208,601	8,452,215	1,018,943
TOTAL COSTS		**4,240,954**	**33,679,798**	**3,520,640**		**7,203,778**	**60,878,126**	**5,924,814**		**5,120,690**	**36,473,479**	**4,309,019**		**5,237,271**	**36,626,265**	**4,415,419**

Table 21-1. (continued).

TEC SUMMARY COMPARISON REPORT

Date: 06/13/01
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RA - Opt. 4A				RA - Opt. 4B				RA - Opt. 4C			
Midpt.	Base Cost	Esc'd Cost	Disc. Cost	Midpt.	Base Cost	Esc'd Cost	Disc. Cost	Midpt.	Base Cost	Esc'd Cost	Disc. Cost
	2,176,301	**5,638,730**	**1,964,783**		**2,062,866**	**5,511,782**	**1,861,455**		**15,632,815**	**22,538,906**	**13,241,662**
	946,415	**4,276,644**	**835,225**		**971,415**	**4,303,698**	**858,595**		**971,415**	**4,303,698**	**858,595**
2003	81,723	88,437	76,395	2003	81,723	88,437	76,395	2003	81,723	88,437	76,395
2003	10,673	11,550	9,977	2003	10,673	11,550	9,977	2003	10,673	11,550	9,977
2003	101,170	109,481	94,574	2003	101,170	109,481	94,574	2003	101,170	109,481	94,574
2003	108,964	117,916	101,860	2003	108,964	117,916	101,860	2003	108,964	117,916	101,860
2003	24,214	26,203	22,635	2003	24,214	26,203	22,635	2003	24,214	26,203	22,635
2003	36,321	39,305	33,953	2003	36,321	39,305	33,953	2003	36,321	39,305	33,953
2003	24,214	26,203	22,635	2003	24,214	26,203	22,635	2003	24,214	26,203	22,635
2003	63,562	68,784	59,418	2003	63,562	68,784	59,418	2003	63,562	68,784	59,418
2003	75,000	81,161	70,110	2003	100,000	108,215	93,480	2003	100,000	108,215	93,480
2050	396,360	3,681,401	321,032	2050	396,360	3,681,401	321,032	2050	396,360	3,681,401	321,032
2003	24,214	26,203	22,635	2003	24,214	26,203	22,635	2003	24,214	26,203	22,635
	156,688	**169,560**	**146,472**		**156,688**	**169,560**	**146,472**		**156,688**	**169,560**	**146,472**
2003	23,510	25,441	21,977	2003	23,510	25,441	21,977	2003	23,510	25,441	21,977
2003	133,178	144,119	124,495	2003	133,178	144,119	124,495	2003	133,178	144,119	124,495
	44,735	**48,410**	**41,818**		**44,735**	**48,410**	**41,818**		**44,735**	**48,410**	**41,818**
2003	44,735	48,410	41,818	2003	44,735	48,410	41,818	2003	44,735	48,410	41,818
	980,034	**1,090,241**	**896,944**		**841,599**	**936,239**	**770,246**		**14,411,548**	**17,956,895**	**12,153,933**
2004	6,452	7,178	5,905	2004	12,903	14,354	11,809	2008	12,903	16,077	10,882
2004	939,627	1,045,290	859,963	2004	788,290	876,935	721,457	2008	14,358,239	17,890,471	12,108,975
2004	9,290	10,335	8,502	2004	9,290	10,335	8,502	2008	9,290	11,575	7,835
2004	6,452	7,178	5,905	2004	12,903	14,354	11,809	2008	12,903	16,077	10,882
2004	18,213	20,261	16,669	2004	18,213	20,261	16,669	2008	18,213	22,694	15,360
	48,429	**53,875**	**44,323**		**48,429**	**53,875**	**44,323**		**48,429**	**60,343**	**40,842**
2004	48,429	53,875	44,323	2004	48,429	53,875	44,323	2008	48,429	60,343	40,842
	2,494,810	**23,171,854**	**2,020,672**		**2,494,810**	**23,171,854**	**2,020,672**		**2,494,810**	**23,171,854**	**2,020,672**
	1,816,070	**16,867,701**	**1,470,926**		**1,816,070**	**16,867,701**	**1,470,926**		**1,816,070**	**16,867,701**	**1,470,926**
2050	1,816,070	16,867,701	1,470,926	2050	1,816,070	16,867,701	1,470,926	2050	1,816,070	16,867,701	1,470,926
	0	**0**	**0**		**0**	**0**	**0**		**0**	**0**	**0**
		0	0			0	0			0	0
	678,740	**6,304,153**	**549,746**		**678,740**	**6,304,153**	**549,746**		**678,740**	**6,304,153**	**549,746**
2050	13,621	126,512	11,032	2050	13,621	126,512	11,032	2050	13,621	126,512	11,032
2050	386,655	3,591,261	313,171	2050	386,655	3,591,261	313,171	2050	386,655	3,591,261	313,171
2050	278,464	2,586,380	225,542	2050	278,464	2,586,380	225,542	2050	278,464	2,586,380	225,542
	25,755	**239,213**	**20,860**		**22,937**	**213,039**	**18,578**		**360,014**	**3,343,819**	**291,593**
2050	25,755	239,213	20,860	2050	22,937	213,039	18,578	2050	360,014	3,343,819	291,593
	4,696,866	**29,049,798**	**4,006,316**		**4,580,613**	**28,896,676**	**3,900,705**		**18,487,639**	**49,054,579**	**15,553,927**
	1,409,060	8,714,939	1,201,895		1,374,184	8,669,003	1,170,212		5,546,292	14,716,374	4,666,178
	6,105,926	**37,764,737**	**5,208,210**		**5,954,797**	**37,565,678**	**5,070,917**		**24,033,931**	**63,770,952**	**20,220,106**

Site inspections and maintenance of fences and surface drainage would be implemented. Monitoring of soil, air, and groundwater would be conducted as described for the no action alternative. Monitoring and inspection results would be evaluated during 5-year reviews to determine whether active remediation is required at specific sites.

21.1.2.2 Evaluation. The limited action alternative could be implemented easily for both the short- and long-term because the specified actions are a continuation of existing management practices. Estimated costs for the limited action alternative are moderate. A summary of costs is provided in Table 21-1.

This alternative is effective for protecting human health by restricting human contact with contamination. Only minor reduction in risk would occur due to natural degradation of contaminants. However, risks to the environment will remain at unacceptable levels. This alternative would be effective in protecting human health only for the period that the institutional control measures were maintained and enforced, which is assumed to be for 100 years. However, after this 100-year period of institutional control, the human health risks would be the same as for the no action alternative. Therefore, the limited action alternative is not an effective remedy. This alternative is screened from further consideration for all WAG 10 TNT/RDX soil sites of concern.

21.1.3 Alternatives 3a and 3b: Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil

Alternatives 3a and 3b are evaluated concurrently because the only difference between them is the disposal site for the soils. For cost estimation purposes, the disposal of contaminated soil in the CFA landfill is evaluated for Alternative 3a. The same excavation and transportation costs to CFA is evaluated in Alternative 3b, but additional costs of rail transportation from CFA, which has a railroad loading facility for off-Site transport, to a private off-Site facility and the disposal fees for the facility are also evaluated.

21.1.3.1 Description. The two removal alternatives, Alternatives 3a and 3b, consist of the following remedial actions to remove and dispose of contaminated soil and TNT/RDX fragments at NODA, Firestation, NOAA, Mine/Fuze, and Fieldstation:

- UXO survey and removal if required
- Characterization of soil for TNT and RDX contamination
- Removal using hand or mechanical excavation techniques and verification sampling
- Segregation of TNT/RDX fragments with detonation at the Mass Detonation Area (MDA)
- Soil transport for onsite or offsite disposal
- Site restoration at the excavation sites
- Institutional controls and long-term environmental monitoring (the same as for the limited action alternative).

21.1.3.1.1 Removal and Sampling—Areas planned for excavation would be gridded, surveyed, and cleared of UXO using standard military techniques if required; characterized for TNT and RDX; and excavated in discrete depth intervals with segregation of the TNT and RDX fragments.

Excavation would only proceed to the depths at which contamination above the primary remediation goals (PRGs) was encountered. Soil excavation and segregation of the TNT and RDX fragments would be performed manually unless safety analysis permitted use of conventional excavation and screening equipment.

The contaminated media would consist of solid fragments of TNT and RDX and soil contaminated with TNT and RDX. The TNT and RDX fragments located on the ground surface are clearly distinguishable. The soil contamination is primarily in the top 20.3 cm (8 in.), although in a few locations the contamination extends to 0.61 m (2 ft). The shallow depths of contaminated media at the WAG 10 TNT/RDX sites of concern allow for manual excavation as well as excavation using front-end loaders and backhoes.

Field screening would be used as a first indication that all soil with contamination above the PRGs was removed. A colorometric method developed by the Army Corps of Engineers could be used in the field to delineate the extent of contamination for removal and reduce the volume of clean soil removed and commingled with contaminated soil. As determined in the remedial design phase, laboratory analysis of representative grab samples would be required to confirm that all soil above PRGs had been removed.

Standard engineering and administrative controls would be used to prevent exposure to TNT and RDX and control air emissions during remediation. Use of appropriate personal protective clothing and equipment would reduce operators exposure to TNT and RDX. Air emissions would be controlled, if necessary, by use of water sprays or soil fixatives to suppress dust during soil excavation and removal.

21.1.3.1.2 Segregation and Detonation of TNT and RDX Fragments—This alternative requires segregation of the TNT and RDX fragments from the soil at the WAG 10 TNT/RDX contaminated soil sites. The TNT and RDX fragments would be manually picked up from the surface, packaged in accordance with safety and transportation requirements, and transported to the MDA for disposal by detonation. However, if safety analysis indicates that it would be safe to use conventional excavation equipment for soil removal, then mechanical screening may be used to separate the TNT and RDX fragments.

21.1.3.1.3 Characterization and Packaging—For Alternative 3a, use of the CFA landfill, no special packaging would be required and bulk shipment of soil would be accepted. Likewise for Alternative 3b, use of an off-Site facility, such as Waste Management Northwest landfill in Arlington, Oregon, for industrial nonhazardous waste, special packaging would not be required and bulk shipments would be accepted. Two assumptions are incorporated into the alternatives: (1) that contaminated soils from the WAG 10 TNT /RDX sites are not RCRA-hazardous and (2) contaminated soils will not exceed 10,000 ppm (1%) TNT and RDX. Efficient logistics dictate that characterization should occur concurrently with retrieval activities. Real-time monitoring during excavation would serve as a component of characterization. As deemed necessary, laboratory analysis of an agreed upon number of representative grab samples would be required to verify the real-time field assessment.

21.1.3.1.4 Transportation—For Alternatives 3a and 3b, trucks would be used to transport the soils from WAG 10 to the CFA and TNT/RDX fragments to the MDA. These costs are the same for both alternatives. Additional costs are associated with Alternative 3b for the rail transport of the soil from the CFA to an approved offsite disposal facility, such as the Waste Management Northwest landfill in Arlington, Oregon. The distance to the road from the WAG 10 TNT and RDX sites averages about two miles, and the rail distance from CFA to Arlington, Oregon, is about 550 miles.

Disposal—Alternative 3a includes on-Site disposal at an approved facility, such as the CFA landfill. Requirements for the disposal of nonhazardous industrial waste at the CFA landfill are officially

established in the INEEL Reusable Property, Recyclable Materials, and Waste Acceptance Criteria, (DOE-ID 1998). The landfill can accept soils contaminated with TNT and RDX as long as the concentration of these contaminants is below 1% (10,000 ppm). Because the CFA accepts bulk shipment of industrial waste, no containerization would be required.

The Waste Management Northwest landfill in Arlington, Oregon, is presently an approved Treatment, Storage, and Disposal Facility (TSDF) that can accept the TNT and RDX contaminated soils provided the contamination level for TNT and RDX is below 1% (10,000 ppm). Bulk rail shipments are permitted at this facility, so no special containerization would be required.

Site Restoration—Following removal of the contaminated soil from WAG 10 TNT/RDX contaminated soil sites, each site would be restored by contouring to the conditions of the surrounding landscape. Areas where excavations exceeded one foot would be backfilled with clean materials. Sites would be revegetated as appropriate in accordance with INEEL revegetation guidance (DOE-ID 1989). Because most excavations will be small and not disturb existing vegetation, it is expected that only 10% of the excavations or less will require revegetation.

Institutional Controls and Long-Term Environmental Monitoring—Institutional controls consisting of access and deed restrictions, and long-term environmental monitoring would be implemented as described under the limited action alternative. Although all detected contaminated soil would be removed, there would still be the potential that buried fragments of TNT and RDX could exist at the sites. Over time, through frost heave, erosion, or construction, the TNT and RDX fragments could reach the surface and pose an unacceptable risk. Undetected TNT and RDX fragments also pose a potential risk to groundwater, hence monitoring would be required.

21.1.3.2 Evaluation. The short-term effectiveness of both Alternatives 3a and 3b for protecting human health and the environment is high. Site personnel and equipment operators would be exposed to minor toxicity exposures during removal activities. However, these exposures could be effectively controlled using standard industrial hygiene precautions and control measures. Long-term protection of human health and the environment is high because contamination would be removed from the site. The toxicity and volume of the contaminants would be reduced due to detonation of the TNT and RDX fragments. Mobility would be reduced because the contaminated soil would be placed in a repository that would greatly impede migration.

Technical and administrative implementability of this alternative is high. Proposed excavation equipment and workers are currently available. Characterization, packaging, transportation, and disposal of contaminated materials all use currently available technologies. The trained personnel and specialized equipment would be available. Long-term implementability is moderate because although contamination would be removed, long-term access controls and monitoring would be required. Any undetected UXO and fragments of TNT and RDX underground will eventually migrate to the surface from frost heave and possibly pose an unacceptable risk.

The estimated short-term effectiveness of this alternative is high. The extra costs associated with Alternative 3b off-Site transportation and disposal make these costs higher than those for Alternative 3a. Both alternatives would have moderate costs associated with the UXO detection and removal safety analysis, satisfying ARARs, and capital and operating costs. The primary capital cost associated with this alternative would be disposal facility fees and transportation. Operation and maintenance costs are high during UXO survey, removal, and soil excavation. This is because of the safety considerations involved, but these operations would take less than 1 year to complete. Estimated capital and operating costs for the removal and disposal alternatives are provided in Table 21-1. Alternatives 3a and 3b will be retained for detailed evaluation.

21.1.4 Alternatives 4a, 4b, and 4c: Removal, Ex Situ Treatment, and Disposal or Return to Excavation

Alternatives 4a, 4b, and 4c are evaluated concurrently because all use an ex situ treatment technology and most of the actions to conduct remediation are the same. The initial survey and removal of UXO is the same for Alternatives 4a, 4b, and 4c. Sampling and removal of contaminated soil are also the same for Alternatives 4a, 4b, and 4c. For Alternatives 4a and 4b, the TNT and RDX fragments would be separated from the soil and detonated onsite; for Alternative 4c the TNT and RDX fragments would be collected with the soil. For Alternative 4a, the soil would be treated and disposed off-Site; for Alternatives 4b and 4c, the soil would be treated on-Site and returned to the excavation sites.

21.1.4.1 Description. Alternatives 4a, 4b, and 4c include the following remedial actions to detect and remove UXO, and sample and remove contaminated soil:

- UXO detection and removal if required
- Characterization of soil for TNT and RDX contamination
- Soil and TNT/RDX removal using hand excavation or, if allowed after safety analysis, mechanical excavation methods, and sampling
- Soil and TNT/RDX treatment and disposition
- Site restoration
- Institutional controls and long-term environmental monitoring (the same as for the limited action alternative).

21.1.4.1.1 Removal and Sampling—Detection and removal of UXO would be the same as described for Alternative 3. For Alternatives 4a and 4b, the removal of soil and fragments of TNT and RDX would also be the same as described for Alternative 3. For Alternative 4c, the fragments of TNT and RDX would not be segregated from the soil, but would be collected along with the soil during excavation. Field screening and verification sampling as described for Alternative 3 would be used for Alternatives 4a, 4b, and 4c.

21.1.4.1.2 Treatment and Disposition—For Alternatives 4a and 4b, the TNT and RDX fragments would be detonated onsite at the MDA. For Alternative 4c, the TNT and RDX fragments would be treated with the soil in a specially designed reactor to be operated on-Site.

For Alternative 4a, the contaminated soil would be shipped to an approved off-Site hazardous waste disposal facility. For cost estimation purposes, the Onyx Environmental Services Treatment Complex in Port Arthur, Texas, was considered the representative thermal treatment and disposal facility. Soils could be shipped in bulk by rail, so there are no special containerization requirements for transport.

Contaminated soil would be treated by windrow composting in Alternative 4b. A temporary portable building would be erected at a central facility, such as the CFA, to provide a controlled environment for the composting process. A mechanical windrow composting machine would be rented to facilitate treatment. The soil would be amended with organic material and mixed several times a day until sampling indicated TNT and RDX levels were below the PRGs. The soil amendment would include such materials as manure, potato waste, sawdust, and alfalfa. It is expected that the soil would be treated within 15 days, after which it would be returned to the excavation sites.

Alternative 4c also uses composting to treat the contaminated soil. However, pretreatment with a solvent such as acetone is required to dissolve the fragments of TNT and RDX before composting can be initiated. This treatment requires design and construction of a special reactor to first add and mix the acetone with the soil, and then add and mix soil amendments. The amendments are the same or similar to those identified for Alternative 4b. A temporary building with VOC emission controls and fire protection would be erected at a central facility such as CFA to provide a controlled environment for the composting process and to control acetone emissions from the process. A controlled and secure area would be provided to store the acetone necessary for treatment. From results of the treatability study, 55 gallons of acetone will be required to treat one ton (1 yd^3) of soil, and it will take approximately 34 days for treatment to achieve PRGs. In accordance with the preliminary cost estimate included in the treatability study report, a full scale system was assumed to treat soil in 10-yd^3 batches. Because of the safety concerns associated with the use of large amounts of acetone, a larger reactor capacity was not considered feasible. After treatment, the soil would be returned to the excavation sites.

Site Restoration—Site restoration for Alternatives 4a, 4b, and 4c are the same as for Alternative 3. For Alternative 4a, soil from a borrow source may be required to restore sites with extensive soil excavations. For Alternatives 4b and 4c, the treated soil would be returned to sites requiring restoration. Sites would be revegetated, as appropriate, in accordance with INEEL revegetation guidance (DOE-ID 1989). Because most excavations will be small and not disturb existing vegetation, it is expected that only 10% of the excavations or less will require revegetation.

Institutional Controls and Long-Term Environmental Monitoring—Institutional controls consisting of access and deed restrictions, and long-term monitoring would be implemented as described under the limited action alternative. Although all detected contaminated soil would be removed, there would still be the possibility that buried fragments of TNT and RDX could exist at the sites.

21.1.4.2 Evaluation. The short-term effectiveness of Alternatives 4a and 4b for protecting human health and the environment is high. Site personnel and equipment operators would be exposed to minor toxicity exposures during removal activities; however, these exposures could be effectively controlled using standard industrial hygiene precautions and control measures. The short-term effectiveness for Alternative 4c is low because it will take up to 7 years to complete remediation. This assumes a one-batch reactor with a capacity to treat 10 yd^3 is constructed and operated, and treatment of each batch requires 25 to 35 days. Long-term protection of human health and the environment is high because contamination would be removed from the site and destroyed. Detonation will destroy the TNT and RDX fragments as specified for Alternatives 4a and 4b, and for Alternative 4c the TNT and RDX fragments would be destroyed through solvent dissolution and biological degradation. The TNT and RDX contamination associated with the soil would be destroyed through incineration (Alternative 4a) and composting (Alternatives 4b and 4c).

Technical and administrative implementability of Alternatives 4a and 4b is high. Proposed excavation equipment and workers are currently available. Characterization, packaging, transportation, treatment, and disposal of contaminated materials all use currently available technologies. The trained personnel and specialized equipment would be available. Technical and administrative implementability for Alternative 4c is low. A full-scale reactor has not yet been designed or demonstrated, dissolution of RDX fragments using acetone has not yet been demonstrated, and the operation requires large quantities of a flammable and toxic solvent, which poses significant environmental and safety issues. Long-term implementability is moderate. Although contamination would be removed, long-term access controls and monitoring would be required because any undetected UXO and fragments of TNT and RDX underground will eventually migrate to the surface from frost heave and possibly pose an unacceptable risk.

The extra costs associated with Alternative 4a for off-Site transportation, treatment, and disposal are higher than those for Alternative 4b, but treatment costs for Alternative 4c are the highest. All alternatives have moderate costs associated with the UXO detection, removal, safety analysis, and excavation of soil and fragments of TNT and RDX. The costs for Alternative 4c are high due to the long time period for treatment, the high quantity of solvent required for treatment, extensive air emission controls, and the other safety and fire protection control measures that would be required. Operation and maintenance costs are high during UXO survey, removal, and soil excavation because of the safety considerations involved, but these operations would take less than 1 year to complete. Estimated capital and operating costs for the removal and disposal alternatives are provided in Table 21-1. Alternative 4c will not be retained for further evaluation due to low short-term effectiveness and implementability and high costs.

21.2 Remedial Alternatives for STF-02 Gun Range

21.2.1 Alternative 1: No Action

21.2.1.1 Description. The NCP (40 CFR 300.430 [e][6]) requires consideration of a no action alternative to serve as a baseline for evaluation of other remedial alternatives. Under the no action alternative, no land use restrictions, controls, or active remedial measures would be implemented at the site. Risk levels would be reduced only through natural processes. Environmental monitoring can be part of a no action alternative while DOE has institutional control of the INEEL, which includes the Site operational period and at least 100 years following Site closure.

Environmental monitoring would be performed to detect contaminant migration and to identify exposures from soil, air, and groundwater. Monitoring results would be used to determine the need for any future remedial actions necessary to protect human health and the environment. Monitoring would be conducted until a future review of the remedial action determined that further monitoring would not be required. Soil, air, and groundwater environmental monitoring activities would be performed under WAG- and INEEL-wide comprehensive monitoring programs to the extent practicable. Chemical surveys would be performed at sites with contaminated media remaining in place as part of this remedial action until Site-wide environmental monitoring programs are implemented. Groundwater monitoring requirements would be identified in reviews conducted every 5 years to evaluate the effectiveness of the institutional controls and the need for further environmental monitoring or additional control measures as applicable. The 5-year site reviews would be conducted for a 100-year period. Air monitoring would be conducted as part of the INEEL-wide air monitoring program.

21.2.1.2 Evaluation. The no action alternative could be implemented easily at moderate cost. However, the no action alternative is ineffective in mitigating risks and does not meet remedial action objectives (RAOs). Estimated costs for the no action alternative are provided in Table 21-2.

21.2.2 Alternative 2: Limited Action

21.2.2.1 Description. Alternative 2 consists of the following remedial actions to protect human health and the environment against potential risks associated with the WAG 10 STF-02 Gun Range site:

- Institutional controls including access and deed restrictions
- Long-term environmental monitoring (the same as for the no action alternative).

Table 21-2. Base cost, escalated cost, and discounted cost (net present value) of capital, operating and maintenance, and total costs for remedial alternatives at WAG 10 STF-02 Gun Range Site.

TEC SUMMARY COMPARISON REPORT

Project WAG 10 OU10-04 FEASIBILITY STUDY - STF GUN RANGE Date: 06/13/01
Location STF-02 GUN RANGE
File # 8950-2

Description	No Action				Limited Action				RA - Opt. 3A				RA - Opt. 3B			
	Midpt.	Base Cost	Esc'd Cost	Disc. Cost	Midpt.	Base Cost	Esc'd Cost	Disc. Cost	Midpt.	Base Cost	Esc'd Cost	Disc. Cost	Midpt.	Base Cost	Esc'd Cost	Disc. Cost
CAPITAL COSTS:		**487,040**	**527,051**	**455,287**		**937,003**	**4,267,710**	**825,618**		**2,907,719**	**3,211,928**	**2,675,913**		**6,648,706**	**7,368,295**	**6,103,156**
Remedial Design		**384,970**	**416,596**	**359,871**		**791,330**	**4,108,819**	**690,251**		**550,055**	**595,243**	**514,193**		**725,055**	**784,620**	**677,784**
RD/RA Statement of Work	2003	54,482	58,958	50,930	2003	54,482	58,958	50,930	2003	81,723	88,437	76,395	2003	281,723	304,867	263,356
Remedial Design Work Plan	2003	17,444	18,877	16,307	2003	17,444	18,877	16,307	2003	10,673	11,550	9,977	2003	10,673	11,550	9,977
Envir., Safety and Health Plan	2003	101,170	109,481	94,574	2003	101,170	109,481	94,574	2003	101,170	109,481	94,574	2003	101,170	109,481	94,574
Sampling and Analysis Plan	2003	108,964	117,916	101,860	2003	108,964	117,916	101,860	2003	108,964	117,916	101,860	2003	108,964	117,916	101,860
Quality Assurance Proj. Plan	2003	12,107	13,102	11,318	2003	12,107	13,102	11,318	2003	24,214	26,203	22,635	2003	24,214	26,203	22,635
Site Ops and Maint. Plan	2003	12,107	13,102	11,318	2003	12,107	13,102	11,318	2003	36,321	39,305	33,953	2003	36,321	39,305	33,953
Draft Final Design/Report Prep.			0	0			0	0	2003	24,214	26,203	22,635	2003	24,214	26,203	22,635
Remedial Action Work Plan	2003	63,562	68,784	59,418	2003	63,562	68,784	59,418	2003	63,562	68,784	59,418	2003	63,562	68,784	59,418
Plans and Specifications			0	0	2003	10,000	10,822	9,348	2003	75,000	81,161	70,110	2003	50,000	54,108	46,740
Deed Restriction Reviews			0	0	2050	396,360	3,681,401	321,032			0	0			0	0
Misc. Envir. Documents	2003	15,134	16,377	14,147	2003	15,134	16,377	14,147	2003	24,214	26,203	22,635	2003	24,214	26,203	22,635
Remediation Support		**66,589**	**72,059**	**62,248**		**66,589**	**72,059**	**62,248**		**156,688**	**169,560**	**146,472**		**156,688**	**169,560**	**146,472**
Quality Assurance			0	0			0	0	2003	23,510	25,441	21,977	2003	23,510	25,441	21,977
Project Office Operations	2003	66,589	72,059	62,248	2003	66,589	72,059	62,248	2003	133,178	144,119	124,495	2003	133,178	144,119	124,495
Remediation/Tech. Support Act.		**35,481**	**38,396**	**33,168**		**37,794**	**40,899**	**35,330**		**44,735**	**48,410**	**41,818**		**44,735**	**48,410**	**41,818**
Engineering & Tech. Support	2003	35,481	38,396	33,168	2003	37,794	40,899	35,330	2003	44,735	48,410	41,818	2003	44,735	48,410	41,818
Remedial Action		**0**	**0**	**0**		**41,290**	**45,933**	**37,789**		**2,107,812**	**2,344,840**	**1,929,106**		**5,673,799**	**6,311,830**	**5,192,758**
Mobilization & Prep. Work			0	0			0	0	2004	12,903	14,354	11,809	2004	12,903	14,354	11,809
Sitework			0	0	2004	41,290	45,933	37,789	2004	2,054,503	2,285,536	1,880,316	2004	5,602,277	6,232,265	5,127,300
Site Restoration			0	0			0	0	2004	9,290	10,335	8,502	2004	9,290	10,335	8,502
Demobilization			0	0			0	0	2004	12,903	14,354	11,809	2004	12,903	14,354	11,809
Other			0	0			0	0	2004	18,213	20,261	16,669	2004	36,426	40,522	33,338
Removal Actions		**0**	**0**	**0**		**0**	**0**	**0**		**48,429**	**53,875**	**44,323**		**48,429**	**53,875**	**44,323**
Summary Report			0	0			0	0	2004	48,429	53,875	44,323	2004	48,429	53,875	44,323
OPERATIONS COSTS:		**2,572,141**	**23,890,107**	**2,083,306**		**2,757,335**	**25,610,193**	**2,233,304**		**0**	**0**	**0**		**0**	**0**	**0**
Cleanup Tech. Admin. Activities		**1,816,070**	**16,867,701**	**1,470,926**		**1,816,070**	**16,867,701**	**1,470,926**		**0**	**0**	**0**		**0**	**0**	**0**
Proj. & Baseline Mgmt./Report	2050	1,816,070	16,867,701	1,470,926	2050	1,816,070	16,867,701	1,470,926			0	0			0	0
Post ROD Ops and Maintenance		**0**	**0**	**0**		**185,194**	**1,720,086**	**149,998**		**0**	**0**	**0**		**0**	**0**	**0**
Caretaker Maintenance			0	0	2050	185,194	1,720,086	149,998			0	0			0	0
Monitoring		**756,071**	**7,022,405**	**612,380**		**756,071**	**7,022,405**	**612,380**		**0**	**0**	**0**		**0**	**0**	**0**
Field Sampling Plan	2050	13,621	126,512	11,032	2050	13,621	126,512	11,032		0	0	0		0	0	0
Sampling	2050	463,986	4,309,513	375,806	2050	463,986	4,309,513	375,806		0	0	0		0	0	0
5-Year Reviews	2050	278,464	2,586,380	225,542	2050	278,464	2,586,380	225,542		0	0	0		0	0	0
G&A and PIF		**0**	**0**	**0**		**1,274**	**11,833**	**1,032**		**53,769**	**499,408**	**43,550**		**141,275**	**1,312,166**	**114,426**
Non-Org G&A and PIF	2050		0	0	2050	1,274	11,833	1,032	2050	53,769	499,408	43,550	2050	141,275	1,312,166	114,426
SUBTOTAL COSTS		**3,059,181**	**24,417,158**	**2,538,593**		**3,695,612**	**29,889,736**	**3,059,954**		**2,961,488**	**3,711,336**	**2,719,463**		**6,789,981**	**8,680,461**	**6,217,582**
Plus: 30% Contingency		917,754	7,325,147	761,578		1,108,684	8,966,921	917,986		888,446	1,113,401	815,839		2,036,994	2,604,138	1,865,275
TOTAL COSTS		**3,976,935**	**31,742,305**	**3,300,171**		**4,804,296**	**38,856,656**	**3,977,941**		**3,849,934**	**4,824,737**	**3,535,302**		**8,826,975**	**11,284,599**	**8,082,857**

Access and deed restrictions would be implemented and enforced, as necessary, to prevent direct and indirect exposure to surface and subsurface contamination.

Access to the INEEL is currently restricted for security and public safety. Because the WAG 10 STF-02 Gun Range soil site is located within the boundaries of the INEEL, Site-wide access restrictions would limit accessibility for the duration of DOE control, which is assumed to be 100 years. Continued maintenance of the existing fences also could be necessary. Other access control measures would include warning signs, assessing trespassing fines, and establishing training requirements for persons allowed access. Land-use restrictions would be specified if government control of the INEEL is not maintained throughout the institutional control period.

Site inspections and maintenance of fences and surface drainage would be implemented. Monitoring of soil, air, and groundwater would be conducted as described for the no action alternative. Monitoring and inspection results would be evaluated during 5-year reviews to determine whether active remediation is required.

21.2.2.2 Evaluation. The limited action alternative could be implemented easily for both the short- and long-term because the specified actions are a continuation of existing management practices. Estimated costs for the limited action alternative are moderate. A summary of costs is provided in Table 21-2.

This alternative can be effective in reducing human health risk due to direct exposure by restricting access to the site. Eventually, groundwater contamination could occur which would then require additional restrictions to avoid exposure. This alternative would be effective in protecting human health only for the period that the institutional control measures were maintained and enforced, which is assumed to be for 100 years. However, after this 100 year period of institutional control, the human health risks would be the same as for the no action alternative. Ecological risks would not be reduced by institutional controls at the STF-02 Gun Range. The limited action alternative is not an effective long-term remedy. This alternative is screened from further consideration for the WAG 10 STF-02 Gun Range soil site.

21.2.3 Alternatives 3a and 3b Removal, Ex Situ Treatment, and Disposition

Alternatives 3a and 3b are evaluated concurrently because both use an ex situ treatment technology and most of the actions to conduct remediation are the same. Soil excavation and sorting to remove metal fragments for recycling, removal, and on-Site disposal of nonhazardous debris, encapsulation and off-Site disposal of the railroad ties and site restoration are remedial actions common to both alternatives. For Alternatives 3a and 3b, the lead-contaminated soil would be sampled after separation of the metal fragments. If the analysis indicated the soil concentration was above PRGs or the RCRA toxicity characteristic leaching procedure (TCLP) for lead, the soil would be treated by ex situ stabilization and disposed on-Site (Alternative 3a) or treated by soil washing and returned to the STF-02 Gun Range Site (Alternative 3b). Monitoring and institutional controls would not be needed after remediation because all contamination above risk-based or regulatory limits would be removed and treated.

21.2.3.1 Description. The two ex situ treatment alternatives, Alternatives 3a and 3b, consist of the following remedial actions to remove, treat, and disposition metal fragments and lead-contaminated soil at the STF-02 Gun Range:

- Excavate the berm and surrounding soil.
- Mechanically screen to remove metal fragments for recycling.

- Sample the soil after screening.
- Treat soil if lead contamination exceeds the PRG and the RCRA TCLP) limit.
- Return soil that is below the PRG and the RCRA TCLP limit for lead to the site. Solidified soil would be disposed at an approved facility.
- Remove, encapsulate, and dispose the lead-impregnated railroad ties at an approved facility.
- Remove and dispose the wooden building and asphalt pads.
- Perform verification sampling.
- Perform site restoration.

21.2.3.1.1 Removal, Screening, and Sampling—The berm and surrounding soils that exceed the PRG for lead or are suspected of containing bullets or metal fragments would be removed using conventional excavation equipment. Field screening would be used as a first indication that all soil with concentrations above the PRG was removed. The soils would then be screened to separate the bullets and other metal fragments. The metal would be sent off-Site to an approved metal recycling facility. An estimated 61 tons of lead and 3.5 tons of copper are available for recovery.

After screening, the soil would be sampled for lead contamination. If sampling results indicate the soil concentration is above the PRG and exceeds the RCRA TCLP limit for lead, then the soil would be treated. If the soil does not exceed the PRG and is below the RCRA TCLP, then the soil would be returned to the site. If the soil exceeds the PRG but is not RCRA toxic for lead, then the soil would be disposed on-Site at an approved disposal facility such as the CFA landfill or the proposed ICDF. Disposal without treatment cannot be developed as a separate alternative because available data are not sufficient to allow evaluation. However, disposal without treatment can be considered as a contingent option to Alternatives 3a and 3b after evaluation of the postscreening soil sampling.

21.2.3.1.2 Soil Treatment and Disposition—Soil treatment under Alternative 3a would involve stabilization of the contaminated soils using a cement-based solidification agent. After treatment, the soil would be disposed on-Site at the CFA landfill or the proposed ICDF. For cost estimation purposes, disposal at the CFA landfill was assumed. Under Alternative 3b, contaminated soil would be treated by washing in an aqueous acid solution to dissolve and remove the lead from the soil particles. Following the mixing period, clean soils would be separated from waste liquid and sludge. The clean soils would be returned to the site. The waste liquid and sludge would be treated and disposed at an approved facility. Solidification is the likely treatment to be performed on the waste liquid and sludge, followed by disposal in an approved landfill, such as the proposed ICDF or the Waste Management Northwest landfill in Arlington, Oregon. For cost estimation purposes, disposal at Waste Management Northwest landfill in Arlington, Oregon, was assumed. Alternatively, the metals may be recovered from the waste solutions and recycled, leaving no hazardous secondary waste for disposal. The generation and disposition of secondary waste will be dependent on the specific soil washing technology selected. Treatability studies will be conducted in order to select the most effective technology and optimize the treatment process.

21.2.3.1.3 Removal, Treatment, and Disposal of Debris—For Alternatives 3a and 3b, removal, treatment, and disposal of construction debris will be the same. The 70 lead-impregnated railroad ties would be encapsulated and disposed as RCRA-regulated debris at an approved landfill either on-Site or off-Site. The most likely on-Site facility would be the proposed ICDF and the most likely

off-Site facility would be the Waste Management Northwest landfill in Arlington, Oregon. For cost estimation purposes, the landfill in Arlington was assumed to be the disposal location. The wooden building and asphalt pads would be removed using conventional demolition and excavating equipment and disposed without treatment at the CFA landfill.

21.2.3.1.4 Verification Sampling and Site Restoration—Verification sampling, which consists of soil sampling and analysis, would be performed at the site under Alternatives 3a and 3b to confirm that all soils with concentrations above the PRG were removed from the site. For Alternative 3b, the site would be restored by contouring to the conditions of the surrounding landscape and backfilling areas where excavations exceeded 1 ft, with clean materials. For Alternative 3b, the cleaned soils would be replaced at the site and contoured to the conditions of the surrounding landscape. For Alternatives 3a and 3b, the site would be revegetated, as appropriate, in accordance with INEEL revegetation guidance (DOE-ID 1989).

21.2.3.2 Evaluation. The short-term effectiveness of both Alternatives 3a and 3b for protecting human health and the environment is high. Site personnel and equipment operators would be exposed to minor toxicity exposures during removal activities. However, these exposures could be effectively controlled using standard industrial hygiene precautions and control measures. Long-term protection of human health and the environment is high because contamination would be removed from the site. The toxicity of the contaminants would not be reduced, however, because lead is not destroyed through treatment. Mobility would be reduced because the lead fragments would be recovered for recycling and the lead in the soil would be either immobilized through stabilization (Alternative 3a) or through removal and subsequent treatment or recycling (Alternative 3b). The volume of contaminated soil would be increased about 30% through stabilization (Alternative 3a), but will not appreciably change as a result of soil washing (Alternative 3b).

Technical and administrative implementability of these alternatives is high. Proposed excavation equipment and workers are currently available. Characterization, treatment, packaging, transportation, and disposal of contaminated materials all use currently available technologies. The trained personnel and specialized equipment would be available. Long-term implementability is high because contamination would be removed and long-term access controls and monitoring would not be required.

The estimated short-term effectiveness of this alternative is high. The costs associated with soil treatment under Alternative 3b are significantly higher than the costs for treatment and disposal under Alternative 3a. Estimated capital and operating costs for the removal and disposal alternatives are provided in Table 21-2. Alternatives 3a and 3b will be retained for detailed evaluation.

21.3 Remedial Alternatives for the UXO Sites

21.3.1 Alternative 1: No Action

21.3.1.1 Description. The NCP requires consideration of a no action alternative to serve as a baseline for evaluation of other remedial alternatives. No land-use restrictions, controls, or active remedial measures would be implemented at the site. Risk levels would be reduced only through other natural processes. Environmental monitoring can be part of a no action alternative while DOE has institutional control of the INEEL, which includes the site operational period and at least 100 years following site closure. The no action alternative is applicable to sites with contamination that does not exceed the level of unacceptable risk and is in compliance with ARARs.

For the UXO areas, conventional environmental monitoring would not be effective or appropriate to identify potential exposures via soil, air, and groundwater. Therefore, monitoring is not included in the

no action alternative for the UXO areas. Although UXO has previously been detected and cleared from selected sites within the UXO area, such as the Mine/Fuze, Rail Car Explosion, NOAA, NODA, and Experimental Field Station, the extent of potential UXO outside of these areas has not been determined. While the UXO area includes gun and bomb ranges, it is most likely that most or all of the projectiles and bombs were practice munitions, which are not capable of detonation. However, it is suspected that some UXO might be present within and around the ranges.

21.3.1.2 Evaluation. The no action alternative could be implemented easily. However, the protectiveness of the no action alternative cannot be fully assessed until the presence of UXO on and around the ranges is confirmed, and the risk associated with any UXO is calculated. Estimated costs for the no action alternative are provided in Table 21-3.

21.3.2 Alternative 2: Limited Action

21.3.2.1 Description. The Limited Action Alternative for the UXO area consists of the following remedial actions:

- Institutional controls
  - Deed restrictions
  - Access restrictions
  - Excavation restrictions
  - Restrictive covenants
  - Signage.

Access to the INEEL is currently restricted for purposes of security and public safety. Sitewide access restrictions would limit accessibility for at least 100 years for the portion of the UXO area that lies within the INEEL boundary. Installation of additional fences or relocation of the existing fences may also be necessary. Other access control measures may include posting warning signs, assessing trespassing fines, and establishing training requirements for persons allowed access. Land-use restrictions may be specified if government control of the INEEL is not maintained. Although these management options provide a means of reducing an immediate risk by controlling potential encounters with UXO, they do not eliminate the risk because the UXO remains in place. Institutional controls are typically used as readily available and proven methods of addressing risk when UXO characterization and removal cannot be conducted in a safe, efficient, or cost-effective manner.

21.3.2.2 Evaluation. The limited action alternative could be implemented easily for both the short and long term because the specified actions are a continuation of existing management practices. Estimated costs for the limited action alternative are low. A summary of costs is provided in Table 21-1.

This alternative would be considered effective for protecting human health and the environment for as long as institutional controls can be maintained. However, the benefit from implementing this level of protection cannot be assessed since risk due to potential UXO has not been determined. The cost for implementing this alternative is provided in Table 21-3. The Limited Action Alternative will be retained for detailed analysis.

Table 21-3. Base cost, discounted cost, and escalated cost (net present value) of capital, operating and maintenance, and total costs for remedial alternatives for WAG 10 UXO areas.

TEC SUMMARY COMPARISON REPORT

Project **WAG 10 OU10-04 FEASIBILITY STUDY - UXO SITES** Date: 06/13/01
Location **UXO AREA**
File # **8952-2**

Description	No Action				Limited Action				RA - Opt. 3			
	Midpt.	Base Cost	Esc'd Cost	Disc. Cost	Midpt.	Base Cost	Esc'd Cost	Disc. Cost	Midpt.	Base Cost	Esc'd Cost	Disc. Cost
CAPITAL COSTS:		**122,540**	**132,607**	**114,551**		**882,875**	**4,228,750**	**762,666**		**10,202,998**	**14,569,562**	**9,309,975**
Remedial Design		**20,470**	**22,152**	**19,135**		**438,937**	**3,727,476**	**360,833**		**896,415**	**4,222,537**	**788,485**
RD/RA Statement of Work			0	0			0	0	2003	81,723	88,437	76,395
Remedial Design Work Plan	2003	5,336	5,774	4,988	2003	5,336	5,774	4,988	2003	10,673	11,550	9,977
Envir., Safety and Health Plan			0	0			0	0	2003	101,170	109,481	94,574
Sampling and Analysis Plan			0	0			0	0	2003	108,964	117,916	101,860
Quality Assurance Proj. Plan			0	0			0	0	2003	24,214	26,203	22,635
Site Ops and Maint. Plan			0	0	2003	12,107	13,102	11,318	2003	36,321	39,305	33,953
Draft Final Design/Report Prep.			0	0			0	0	2003	24,214	26,203	22,635
Remedial Action Work Plan			0	0			0	0	2003	63,562	68,784	59,418
Plans and Specifications			0	0	2003	10,000	10,822	9,348	2003	25,000	27,054	23,370
Deed Restriction Reviews			0	0	2050	396,360	3,681,401	321,032	2050	396,360	3,681,401	321,032
Misc. Envir. Documents	2003	15,134	16,377	14,147	2003	15,134	16,377	14,147	2003	24,214	26,203	22,635
Remediation Support		**66,589**	**72,059**	**62,248**		**66,589**	**72,059**	**62,248**		**156,688**	**169,560**	**146,472**
Quality Assurance			0	0			0	0	2003	23,510	25,441	21,977
Project Office Operations	2003	66,589	72,059	62,248	2003	66,589	72,059	62,248	2003	133,178	144,119	124,495
Remediation/Tech. Support Act.		**35,481**	**38,396**	**33,168**		**37,794**	**40,899**	**35,330**		**44,735**	**48,410**	**41,818**
Engineering & Tech. Support	2003	35,481	38,396	33,168	2003	37,794	40,899	35,330	2003	44,735	48,410	41,818
Remedial Action		**0**	**0**	**0**		**339,555**	**388,315**	**304,255**		**9,056,731**	**10,075,180**	**8,288,876**
Mobilization & Prep. Work			0	0			0	0	2004	12,903	14,354	11,809
Sitework			0	0	2005	339,555	388,315	304,255	2004	9,012,712	10,026,211	8,248,589
Site Restoration			0	0			0	0			0	0
Demobilization			0	0			0	0	2004	12,903	14,354	11,809
Other			0	0			0	0	2004	18,213	20,261	16,669
Removal Actions		**0**	**0**	**0**		**0**	**0**	**0**		**48,429**	**53,875**	**44,323**
Summary Report			0	0			0	0	2004	48,429	53,875	44,323
OPERATIONS COSTS:		**2,094,534**	**19,454,081**	**1,696,468**		**3,946,474**	**36,654,944**	**3,196,448**		**3,946,474**	**36,654,944**	**3,196,448**
Cleanup Tech. Admin. Activities		**1,816,070**	**16,867,701**	**1,470,926**		**1,816,070**	**16,867,701**	**1,470,926**		**1,816,070**	**16,867,701**	**1,470,926**
Proj. & Baseline Mgmt./Report	2050	1,816,070	16,867,701	1,470,926	2050	1,816,070	16,867,701	1,470,926	2050	1,816,070	16,867,701	1,470,926
Post ROD Ops and Maintenance		**0**	**0**	**0**		**1,851,940**	**17,200,863**	**1,499,979**		**1,851,940**	**17,200,863**	**1,499,979**
Caretaker Maintenance			0	0	2050	1,851,940	17,200,863	1,499,979	2050	1,851,940	17,200,863	1,499,979
Monitoring		**278,464**	**2,586,380**	**225,542**		**278,464**	**2,586,380**	**225,542**		**278,464**	**2,586,380**	**225,542**
Field Sampling Plan			0	0			0	0			0	0
Sampling			0	0			0	0			0	0
5-Year Reviews	2050	278,464	2,586,380	225,542	2050	278,464	2,586,380	225,542	2050	278,464	2,586,380	225,542
G&A and PIF		**0**	**0**	**0**		**8,683**	**80,648**	**7,033**		**210,958**	**1,959,383**	**170,865**
Non-Org G&A and PIF			0	0	2050	8,683	80,648	7,033	2050	210,958	1,959,383	170,865
SUBTOTAL COSTS		**2,217,074**	**19,586,688**	**1,811,019**		**4,838,032**	**40,964,341**	**3,966,146**		**14,360,430**	**53,183,889**	**12,677,288**
Plus: 30% Contingency		665,122	5,876,006	543,306		1,451,410	12,289,302	1,189,844		4,308,129	15,955,167	3,803,186
TOTAL COSTS		**2,882,196**	**25,462,695**	**2,354,325**		**6,289,442**	**53,253,644**	**5,155,990**		**18,668,559**	**69,139,056**	**16,480,475**

21.3.3 Alternative 3: UXO Detection, Removal, and Institutional Controls

21.3.3.1 Description. Alternative 3 for the UXO area consists of the following remedial actions:

- UXO surveys and UXO removal
- Institutional controls
  - Deed restrictions
  - Access restrictions
  - Excavation restrictions
  - Restrictive covenants
  - Signage.

Geophysical surveys would be conducted over the areas shown on Figure 20-1 to identify potential UXO. Anomalies detected from the surveys would be noted and for the anomalies detected within the INEEL boundary, further investigated to determine whether intrusive investigation was necessary to remove suspect items. Any items removed that could be UXO would be detonated on-Site at the Mass Detonation Area unless it was determined to be too hazardous to transport, in which case the UXO would be detonated at the location it was detected. Other non-UXO items recovered, such as shrapnel, would be disposed at the CFA landfill.

Geophysical investigations for buried munitions are seldom 100% effective. In many cases, a munition is buried too deep, is too small to be detected, or is constructed of a material difficult to detect. Later, through frost heave, erosion, or construction, the item can reach the surface. Also, because the total amount of munitions buried at a site is almost never known, complete recovery cannot be documented. Therefore, periodic surveys may be required and institutional controls established and maintained. For purposes of cost estimation, it was assumed that a helicopter boom-mounted magnetic detection system would be used to perform the UXO survey. The survey would detect potential UXO sites beyond the currently known sites. The need for additional surveys will be determined from results of the initial survey.

Access to the INEEL is currently restricted for purposes of security and public safety. Site-wide access restrictions would limit accessibility for at least 100 years for the portion of the UXO area that lies within the INEEL boundary. Installation of additional fences or relocation of the existing fences may also be necessary. Other access control measures may include warning signs, assessing trespassing fines, and establishing training requirements for persons allowed access. Land-use restrictions may be specified if government control of the INEEL is not maintained throughout the institutional control period.

21.3.3.2 Evaluation. Alternative 3 would be effective in reducing risk through detection and removal of UXO, if present, and by restricting access and activities within the suspect UXO areas. Implementation is considered moderate because of the technical difficulties in differentiating UXO from inert metal fragments. But, the institutional controls could be implemented easily for both the short and long term, because the specified actions are a continuation of existing management practices. Estimated costs for Alternative 3 are high. A summary of costs is provided in Table 21-3. This alternative will be retained for detailed analysis.

21.4 Screening of Alternatives Summary

In the preceding subsections, each remedial action alternative was defined to provide sufficient quantitative information to allow differentiation among the alternatives for effectiveness, implementability, and cost. Results of these evaluations are now used for comparing alternatives with each GRA relative to each other. Screening on a relative basis allows for either eliminating alternatives from further evaluation or retaining alternatives for detailed analysis.

Alternatives may be screened from further consideration on the basis of relative effectiveness within a GRA or if an alternative is not implementable. An alternative can be screened on the basis of cost only when the relative effectiveness and implementability of other alternatives are equal. Alternatives also can be screened on the basis of unjustifiable cost relative to increased effectiveness or implementability. The screening process is only a preliminary evaluation, and alternatives are generally retained unless a clear basis for rejection is defined (EPA 1988).

21.4.1 TNT/RDX Contaminated Soils

21.4.1.1 Alternative 1: No Action. As required by the NCP, the no action alternative was retained for detailed analysis to serve as the baseline for comparing other remedial action alternatives. However, the no action alternative would not address the risks identified in the BRA and would not satisfy RAOs established for WAG 10.

21.4.1.2 Alternative 2: Limited Action. The limited action alternative is effective for protecting human health during the 100-year period of institutional control but would provide little or no reduction of environmental risks. However, once the specified actions (i.e., surface water diversion, access restrictions, and environmental monitoring) are either no longer conducted or enforced, risks to both human health and the environment would be equivalent to the no action and would not satisfy RAOs. Therefore, this alternative was eliminated from further consideration for all sites.

21.4.1.3 Alternatives 3a and 3b: Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil. Both removal and disposal options, Alternatives 3a and 3b, are effective in preventing exposure from the TNT and RDX contaminated sites in the short and long term. Alternative 3a short-term costs are lower than those of Alternative 3b, because the extra transportation costs are avoided and the disposal fees are lower. Alternatives 3a and 3b are retained for detailed analysis in Section 22.

21.4.1.4 Alternatives 4a, 4b, and 4c: Removal, Ex Situ Treatment, Disposal or Return to Excavation. Short-term cost estimates for excavation, ex situ treatment, and disposal alternatives are higher than for the removal and disposal alternatives. All alternatives would be effective in reducing risk through destruction of the TNT and RDX contamination. However, implementation of Alternative 4c would be difficult due to safety concerns over the large quantity of hazardous and toxic solvent required to dissolve the fragments of TNT and RDX, and the time period required for treatment (up to 7 years). The cost for Alternative 4c is also much higher than for Alternatives 4a and 4b. Therefore, Alternative 4c is eliminated from further consideration and only Alternatives 4a and 4b will be retained for detailed analysis in Section 22.

21.4.2 STF-02 Gun Range

21.4.2.1 Alternative 1: No Action. As required by the NCP, the no action alternative was retained for detailed analysis to serve as the baseline for comparing other remedial action alternatives. However, the no action alternative would not address the risks identified in the BRA and would not satisfy RAOs established for WAG 5.

21.4.2.2 Alternative 2: Limited Action. The limited action alternative is effective for protecting human health during the 100-year period of institutional control, but would provide no reduction of environmental risks. However, once the specified actions (e.g., deed restrictions, access restrictions, and environmental monitoring) are either no longer conducted or enforced, risks to both human health and the environment would be equivalent to the no action and would not satisfy RAOs. Therefore, the limited action alternative for STF-02 Gun Range lead contaminated soils was screened from further consideration.

21.4.2.3 Alternative 3a and 3b: Removal, Ex Situ Treatment, and Disposition. Alternative 3 provides high long-term effectiveness because all the contamination above PRGs would be removed from the site; the metal fragments would be recovered for recycling, and lead contamination would be immobilized and removed from the site. The hazardous debris would be encapsulated and disposed in a secure landfill off-Site. Short-term effectiveness is high for Alternative 3a because of the immediate availability of technologies to treat the lead-contaminated soil and disposal facilities for treated soils and debris. Short-term effectiveness for 3b is lower due to use of acid, a hazardous substance, in the treatment process and production of significant quantities of hazardous secondary waste that will require treatment and disposal. Alternatives 3a and 3b were retained for detailed analysis in Section 22.

21.4.3 UXO Areas

21.4.3.1 Alternative 1: No Action. As required by the NCP, the no action alternative was retained for detailed analysis to serve as the baseline for comparing other remedial action alternatives. The no action alternative may be protective of human health and the environment if UXO is absent from the areas.

21.4.3.2 Alternative 2: Limited Action. If UXO is present within the defined areas, the limited action alternative would be effective in protecting human health for as long as institutional controls were enforced and maintained. The limited action alternative is retained for detailed analysis.

21.4.3.3 Alternative 3: UXO Detection, Removal, and Institutional Controls. Alternative 3 provides moderate short- and long-term effectiveness because no method of UXO detection and removal is considered to be 100% effective. Implementability is also moderate because of the technical difficulties in distinguishing UXO from other metallic debris and inert munitions, and the safety hazards associated with UXO removal. The cost is high, and this alternative is retained for detailed analysis because it is presently the only process that has been proven effective at removing and destroying UXO.

21.5 References

40 CFR 300, 1997, *Code of Federal Regulations*, Title 40, "Protection of the Environment," Part 300, *National Oil and Hazardous Substances Pollution Contingency Plan.*

DOE-ID, 1989, *Guidelines for Revegetation of Disturbed Sites at the INEL*, DOE/ID-12114, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, January 1998, *INEEL Reusable Property, Recyclable Materials, and Waste Acceptance Criteria*, DOE/ID-10381.

EPA, 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*, EPA/540/G-89/004, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency.